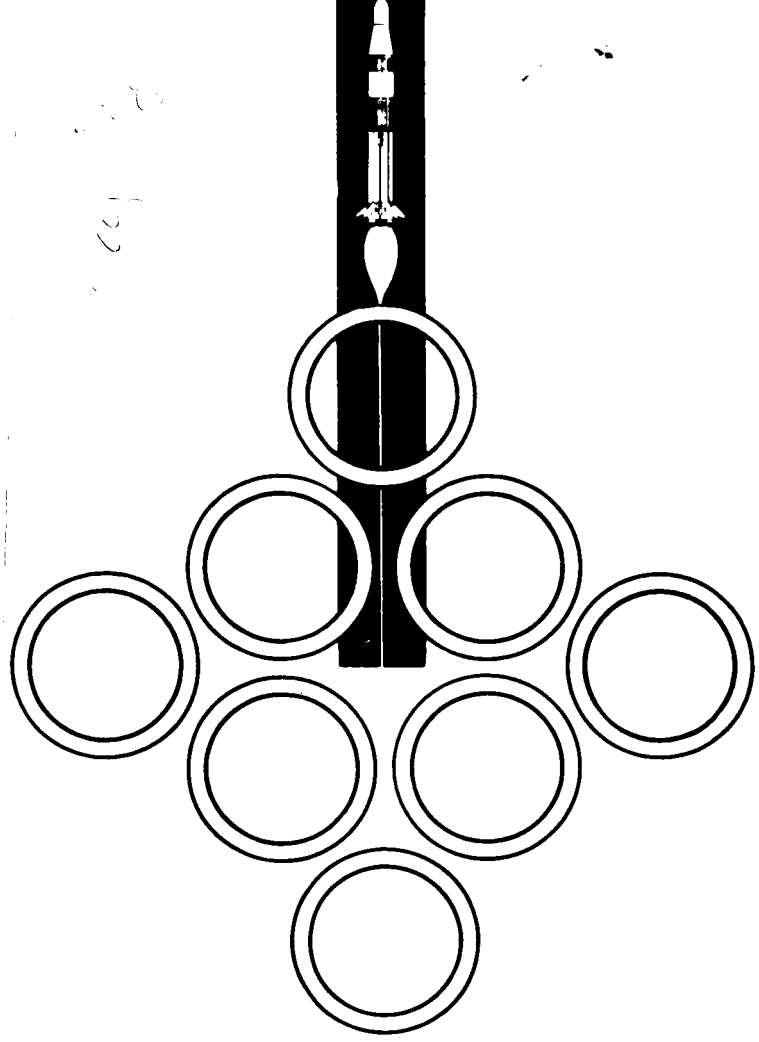

ENGINEERING DEPARTMENT

# TECHNICAL REPORT

TR-RE-CCSD-FO-1096-3

February 15, 1967

# SATURN IB PROGRAM

## TEST REPORT
## FOR

BALL VALVE, 2-INCH, MANUALLY OPERATED

Hills-McCanna Company Part Number F602-S6-T

NASA Drawing Number 75M04047 HBV-2



SPACE DIVISION CHRYSLER CORPORATION

# TEST REPORT
# FOR
# BALL VALVE, 2-INCH, MANUALLY OPERATED
# Hills-McCanna Company Part Number F602-S6-T
# NASA Drawing Number 75M04047 HBV-2

## ABSTRACT

This report presents the results of tests performed on one specimen of manually operated Ball Valve 75M04047 HBV-2. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Surge
5. Icing
6. Cycle
7. Sand and Dust
8. Salt Fog
9. Temperature Shock
10. Burst

The specimen performance was in accordance with the requirements of NASA drawing 75M04047 HBV-2, except following 1000 cycles of the cycle test and following the salt fog test.

The specimen was inspected after the cycle test and flakes of seat material were found inside specimen. The leakage recorded following 1000 cycles and following the salt fog test is attributed to this deterioration of the valve seat.

Consideration should be given to establishing a periodic inspection of the valve.

# FOREWORD

The tests reports herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS8-4016, Part VII, CWO 271620.

# TEST REPORT

FOR

BALL VALVE, 2-INCH, MANUALLY OPERATED

Hills-McCanna Company Part Number F602-S6-T

NASA Drawing Number 75M04047 HBV-2

February 15, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

3214-3-16-67

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## TEST SUMMARY

BALL VALVE 75MO4047 HBV-2

| Environment | Units | Operational Boundary | Test Objective | Test Results | Remarks |
|---|---|---|---|---|---|
| Receiving Inspection | 1 | Comply with NASA drawing 75MO4047 HBV-2 and vendor drawing F602-S6-T | Comply with NASA drawing 75Mo4047 HBV-2 and vendor drawing F602-S6-T | Satis-factory | |
| Proof Pressure | 1 | 400 psig | Check for leakage and distortion | Satis-factory | No leakage or distortion |
| Functional Test | 1 | 10 psig 200 psig | Check for leakage at 10 psig and 200 psig | Satis-factory | No leakage |
| Surge | 1 | 0 to 200 psig in 0.1 seconds 25 cycles for each port | Determine if specimen operation is impaired by surge | Satis-factory | Test completed |
| Icing Test | 1 | ½-inch ice at 5°F | Determine if specimen operation is impaired by icing | Satis-factory | Test completed |
| Cycle Test | 1 | 1000 open-close cycles | Determine if specimen operation is impaired by cycling | Satis-factory | Leakage after 1000 cycles |
| Sand and Dust | 1 | Sand and dust for 4 hours | Determine if specimen operation is impaired by sand and dust | Satis-factory | Test completed |
| Salt Fog | 1 | Salt fog exposure for 10 days | Determine if specimen operation is impaired by salt fog | Satis-factory | Leakage recorded but not result of salt fog exposure |
| Temperature Shock | 1 | 125 to 0°F | Determine if specimen operation is impaired by temperature shock | Satis-factory | Test completed |
| Burst | 1 | 800 psig then pressurize to rupture | Check for leakage at 800 psig; determine rupture pressure | Satis-factory | No leakage or distortion at 800 psig; rupture at 8000 psig |

CHECK SHEET

FOR

BALL VALVE, 2-INCH, MANUALLY OPERATED

MANUFACUTRER: Hills-McCanna Company
MANUFACTURER'S PART NUMBER: F602-S6-T
NASA DRAWING NUMBER: 75M04047 HBV-2
TEST AGENCY: Chrysler Corporation Space Division, New Orleans, La.
AUTHORIZING AGENCY: NASA EDV-14

I. FUNCTIONAL REQUIREMENTS

| | | |
|---|---|---|
| A. | OPERATING MEDIUM: | Gaseous nitrogen and hydrogen |
| B. | OPERATING PRESSURE: | Valve - 10-to 200-psig |
| C. | VALVE LEAKAGE: | Internal - 1 sccm at 10 psig<br>External - none |
| D. | VALVE OPERATION: | Manual lever |

II. CONSTRUCTION

| | | |
|---|---|---|
| A. | VALVE BODY AND BALL MATERIAL: | Stainless steel |
| B. | VALVE SEALS MATERIAL | Teflon |

III. ENVIRONMENTAL REQUIREMENTS

| | | |
|---|---|---|
| A. | TEMPERATURE RANGE: | 125 to 0°F |

IV. LOCATION AND USE:

Used at Launch Complexes 34 and 37 in the $LH_2$ vent system.

# SECTION I

# INTRODUCTION

## 1.1 SCOPE

This report presents the results of tests performed to determine if Ball Valve 75M04047 HBV-2 meets the operational requirements for John F. Kennedy Space Center Launch Complexes 34 and 37. A summary of the test results is presented on page viii.

## 1.2 ITEM DESCRIPTION

1.2.1 One specimen of Ball Valve 75M04047 HBV-2 was tested. The valve is a 2-inch, manually operated ball valve used in the $LH_2$ vent system at Launch Complexes 34 and 37.

1.2.2 The valve body and ball are stainless steel and the valve seats are Teflon. The valve is fitted with 2-inch female pipe threaded connections and is manufactured by Hills-McCanna Company.

## 1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Ball Valve 75M04047 HBV-2:

a. KSC-STD-164(D), dated September 17, 1964, Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy

b. NASA Drawing 75M04047 HBV-2

c. Cleaning Standard MSFC-STD-164(D)

d. Test Plan CCSD-FO-1096-1R (Rev. A)

e. Test Procedure TP-RE-CCSD-FO-1096-2R(Rev A)

## SECTION II

## RECEIVING INSPECTION

### 2.1 TEST REQUIREMENTS

Each specimen shall be visually and dimensionally inspected for conformance with the applicable specifications prior to the start of the tests.

### 2.2 TEST PROCEDURE

A visual and dimensional inspection was performed to determine compliance with NASA drawing 75M04047 HBV-2 and applicable vendor drawings to the extent possible without disassembling the test specimen. At the same time the test specimen was inspected for poor workmanship and manufacturing defects.

### 2.3 TEST RESULTS

The specimen complied with NASA drawing 75M04047 HBV-2 and Hills-McCanna drawing number BVA F602-1. No evidence of poor workmanship or manufacturing defects was observed .

### 2.4 TEST DATA

The data presented in tables 2-1 were recorded during the inspection.

Table 2-1. Specimen Specifics

| | |
|---|---|
| Name | McCannaflo Ball Valve |
| Size | 2-in. |
| Model | F602-S6-T |
| Length | 4-$\frac{1}{2}$ in. |
| Outside Diameter | 3-$\frac{1}{2}$ in. |
| Handle Length | 8-$\frac{1}{2}$ in. |
| Connections | 2-in. FPT |

## SECTION III

## PROOF PRESSURE TEST

### 3.1 TEST REQUIREMENTS

3.1.1 The test specimen shall be subjected to a $GN_2$ proof pressure of 400 psig for 5 minutes.

3.1.2 The test specimen shall be examined for leakage and distortion.

### 3.2 TEST PROCEDURE

3.2.1 The test setup shown in figures 3-1 and 3-2 was assembled using the equipment listed in table 3-1. All hand valves and regulators were closed.

3.2.2 The inlet of hand valve 4 was pressurized to 3000 psig using pressure source 2. Hand valve 4 was opened. The 3000-psig pressure was monitored on gage 6.

3.2.3 The test specimen and hand valve 8 were opened. Regulator 7 was adjusted to pressurize the test specimen to 400 psig. The 400-psig pressure was monitored on gage 9.

3.2.4 Hand valve 8 was closed. The specimen was checked for leakage for 5 minutes. Gage 9 was monitored for an indication of a test specimen pressure drop.

3.2.5 Following the 5-minute leakage check period, regulator 7 was closed. The test specimen pressure was relieved by opening hand valve 10.

3.2.6 The test specimen was removed from the test setup and examined for evidence of distortion.

### 3.3 TEST RESULTS

The specimen did not leak and there was no evidence of distortion.

### 3.4 TEST DATA

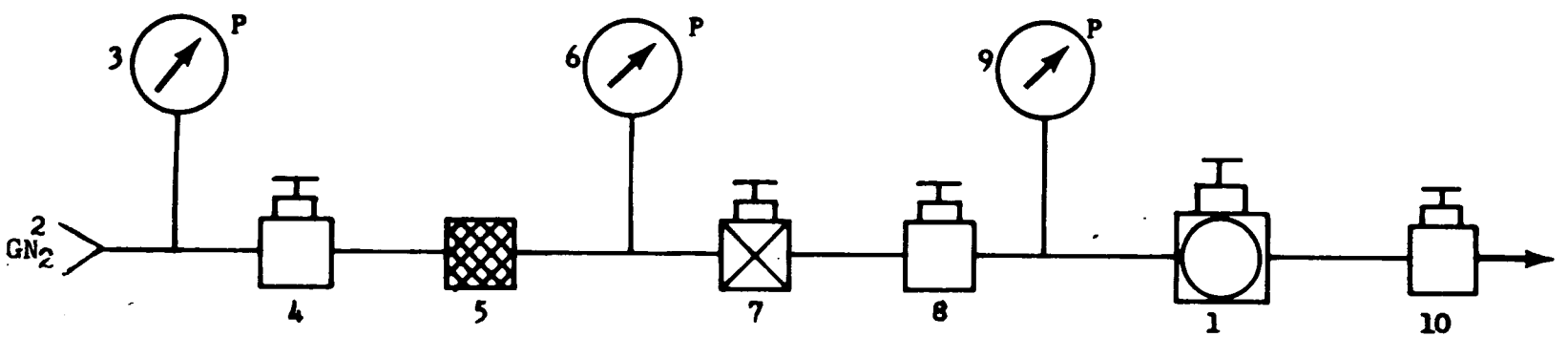
The data presented in table 3-2 were recorded during the test.

Table 3-1. Proof Pressure Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch, manually operated |
| 2 | $GN_2$ Pressure Source | | NA | NA | 3000-psig |
| 3 | Pressure Gage | Ashcroft | 1057S | NA | 0-to 5000-psig |
| 4 | Hand Valve | Robbins Aviation, Inc. | SSNA-250-4T | NA | ¼-inch |
| 5 | Filter | Bendix Filter Dv. | 2-S-13460-16-B-0 | NA | 2-micron |
| 6 | Pressure Gage | Ashcroft | NA | 200595K | 0-to 5000-psig 1.0% FS accuracy Cal. date 10-21-66 |
| 7 | Regulator | Tescom | 26-1003 | NA | 0-to 500-psig |
| 8 | Hand Valve | Robbins Aviation, Inc. | SSNA-250-4T | NA | ¼-inch |
| 9 | Pressure Gage | Heise | H41043 | 08-113-106443 | 0-to 500-psig 1.0% FS accuracy Cal. date 10-20-66 |
| 10 | Hand Valve | Robbins Aviation, Inc. | SSNA-250-4T | NA | ¼-inch |

Table 3-2. Proof Pressure Test Data

| | |
|---|---|
| Pressure | 400 psig for 5 minutes |
| Leakage | zero |
| Distortion | None |




Note: All lines are 1/4-inch.
Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure Test Schematic

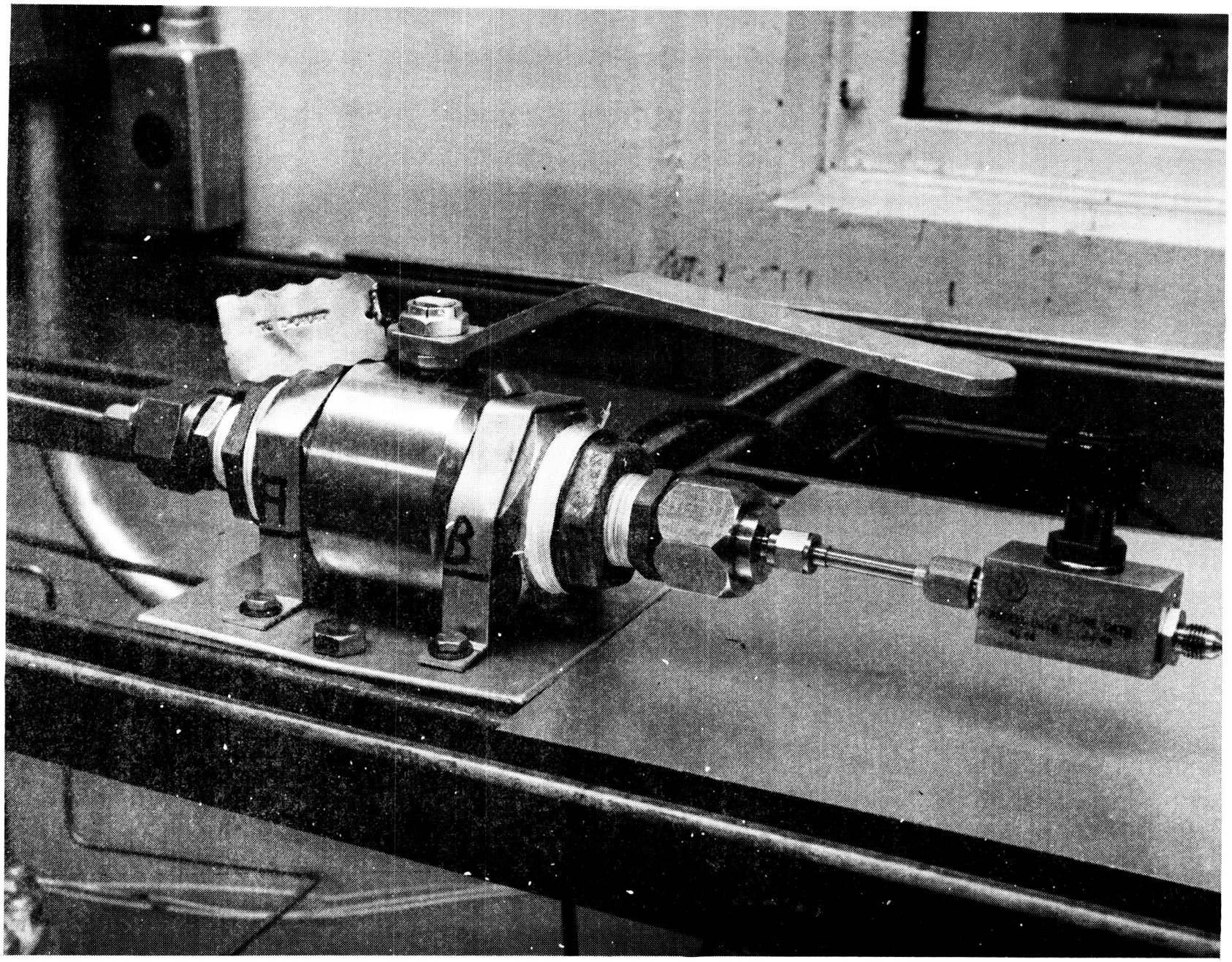


Figure 3-1. Proof Pressure Test Setup

## SECTION IV

## FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 The specimen shall be checked for leakage at 10 psig for 5 minutes. Maximum internal leakage is 1 sccm at 10 psig.

4.1.2 The specimen shall be checked for leakage at 200 psig for 5 minutes

4.1.3 Following the leakage check at 200 psig, the specimen shall be checked for leakage at 10 psig for 5 minutes

4.2 TEST PROCEDURE

4.2.1 The test setup shown in figures 4-1 and 4-2 was assembled using the equipment listed in table 4-1. All hand valves, the test specimen, and regulator 7 were closed.

4.2.2 The inlet of hand valve 4 was pressurized to 3000 psig using pressure source 2. Hand valve 4 was opened. The 3000-psig pressure was monitored on gage 6.

4.2.3 Regulator 7 was adjusted to pressurize the inlet of the specimen to 10 psig. The 10-psig pressure was monitored on gage 8.

4.2.4 The specimen was checked for internal leakage for 5 minutes. Leakage was checked by monitoring water bath 10 for bubbles. A soap solution was used to check the specimen for external leakage. The leakage data were recorded.

4.2.5 Regulator 7 was adjusted to pressurize the specimen to 200 psig. The 200-psig pressure was monitored on gage 8.

4.2.6 The specimen was checked for internal leakage for 5 minutes. Leakage was checked by monitoring water bath 10. A soap solution was used to check the specimen for external leakage. The leakage data were recorded.

4.2.7 Regulator 7 was closed and hand valve 9 was opened to vent the specimen.

4.2.8 Hand valve 9 was closed and regulator 7 was adjusted to pressurize the specimen to 10 psig. The 10-psig pressure was monitored on gage 8.

4.2.9 The specimen was checked for internal leakage for 5 minutes by monitoring water bath 10. A soap solution was used to check the specimen for external leakage. The leakage data were recorded.

4.2.10 The test specimen pressure was relieved by closing regulator 7 and venting through the regulator.

4.2.11 The test specimen was re-installed in the test setup so that the outlet was connected to regulator 7 and the inlet was connected to water bath 10.

4.2.12 The tests described in paragraphs 4.2.3 through 4.2.10 were performed by pressurizing the test specimen outlet and checking for leakage.

## 4.3 TEST RESULTS

All initial functional test results were satisfactory. No leakage from the specimen was recorded.

## 4.4 TEST DATA

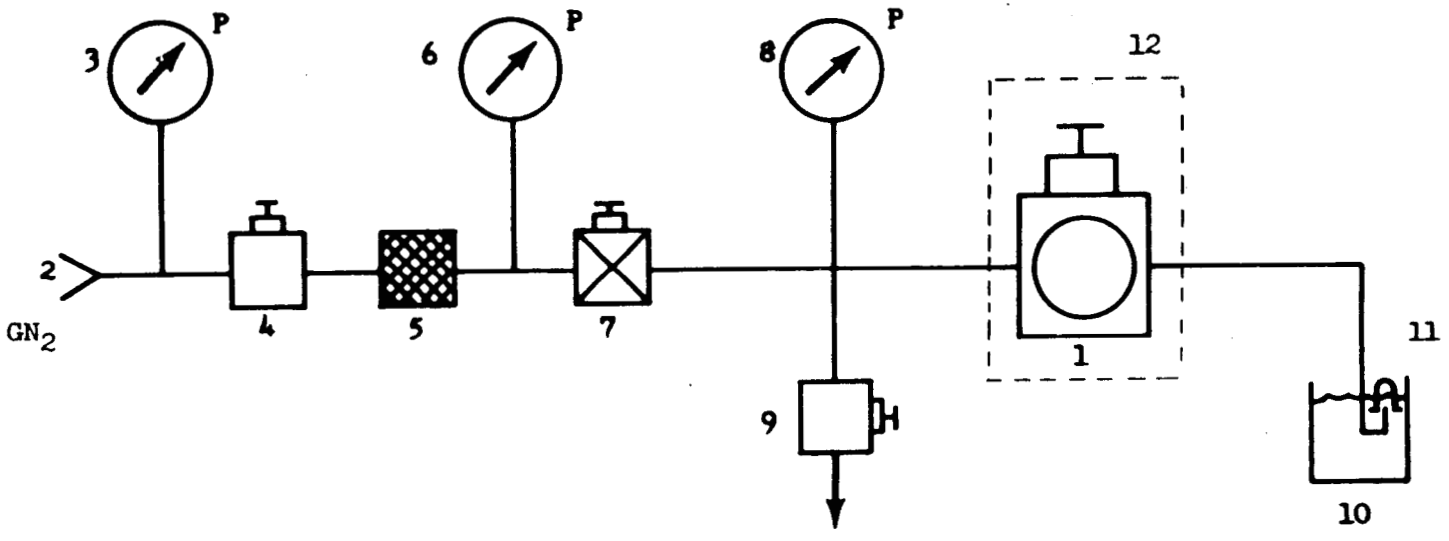
The data presented in table 4-2 were recorded during the initial functional test.

Table 4-1. Functional Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch manually operated |
| 2 | $GN_2$ Source | | NA | NA | 3000-psig |
| 3 | Pressure Gage | Ashcroft | 1057S | NA | 0-to 5000-psig |
| 4 | Hand Valve | Robbins Aviation, Inc. | SSNA 250-4T | NA | ¼-inch |
| 5 | Filter | Bendix | S-13460 -16-B-0 | NA | 2-micron |
| 6 | Pressure Gage | Ashcroft | NA | 500595K | 0-to 5000-psig 1.0% FS accuracy Cal. date 10-21-66 |
| 7 | Pressure Regulator | Tescom | 26-1003 | NA | 0-to 250-psig |
| 8 | Pressure Gage | Heise | NA | 08-113-106443 | 0-to 500-psig 0.1% FS accuracy Cal. date 10-21-66 |
| 9 | Hand Valve | Robbins Aviation, Inc. | SSNA 250-4T | NA | ¼-inch |
| 10 | Water Bath | | NA | NA | |
| 11 | Graduated Cylinder | | NA | NA | 50-cc |
| 12 | Icing Chamber | CCSD | NA | NA | As specified in KSC-STD-164(D) (Icing test only) |

Table 4-2. Initial Functional Test Data

| Outlet Pressure (psig) | Leakage from Inlet (sccm) | Inlet Pressure (psig) | Leakage From Outlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |




Note: All lines 1/4-inch.
Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic

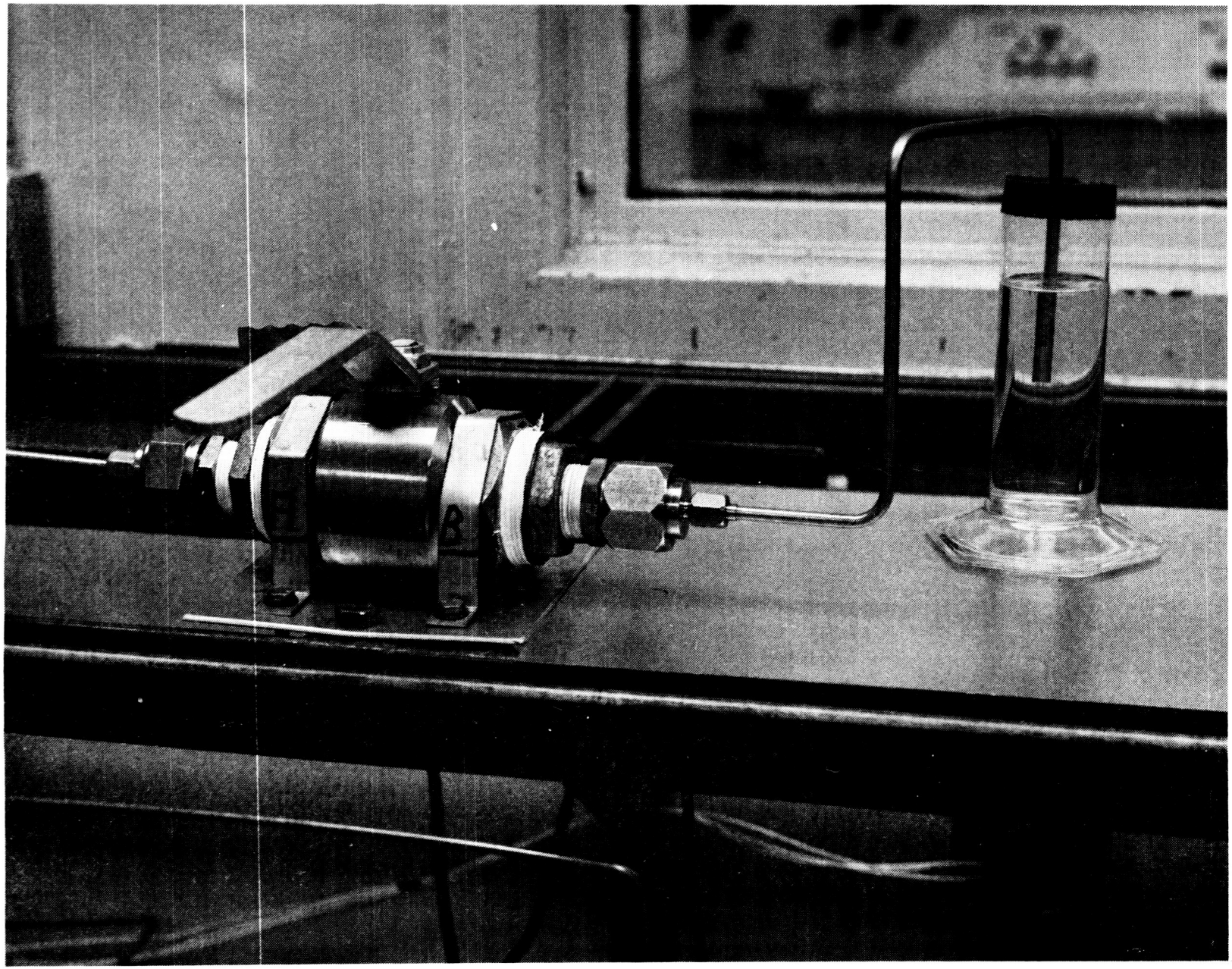


Figure 4-2. Functional Test Setup

## SECTION V

## SURGE TEST

5.1 TEST REQUIREMENTS

5.1.1 The test specimen inlet and outlet each shall be subjected to 25 pressure surges.

5.1.2 Each pressure surge shall be a pressure increase from zero to 200 psig within 100 milliseconds.

5.1.3 The test specimen shall be subjected to a functional test as specified in section IV following the surge test.

5.2 TEST PROCEDURE

5.2.1 The test setup shown in figures 5-1 and 5-2 was assembled using the equipment listed in table 5-1. All hand valves, the test specimen and regulator 7 were closed.

5.2.2 The inlet of hand valve 4 was pressurized to 3000 psig with $GN_2$ from pressure source 2. Hand valve 4 was opened and the 3000-psig pressure was monitored on gage 6.

5.2.3 Regulator 7 was adjusted to pressurize the inlet of solenoid valve 9 to 200 psig. The 200-psig pressure was monitored on gage 8.

5.2.4 Hand valve 10 was opened and solenoid valve 9 was actuated. The test specimen pressurization rate was monitored with oscillograph 12. Hand valve 10 was adjusted so that the test specimen inlet was pressurized from zero to 200 psig within 100 milliseconds when solenoid valve 9 was actuated. Solenoid valve 13 was actuated to vent the pressure to zero psig.

5.2.5 The test specimen inlet was subjected to 25 pressure surges by alternately actuating and deactuating solenoid valves 9 and 13 twenty-five times.

5.2.6 The test specimen was disconnected and then reinstalled so that the outlet could be pressurized.

5.2.7 The test specimen outlet was subjected to 25 pressure surges by alternately actuating and deactuating solenoid valves 9 and 13 twenty-five times.

5.2.8 Following completion of the surge test, the specimen was subjected to a functional test as specified in section IV.

## 5.3 TEST RESULTS

The test specimen inlet and outlet were each subjected to 25 pressure surges. Functional test results following the surge test were satisfactory.

## 5.4 TEST DATA

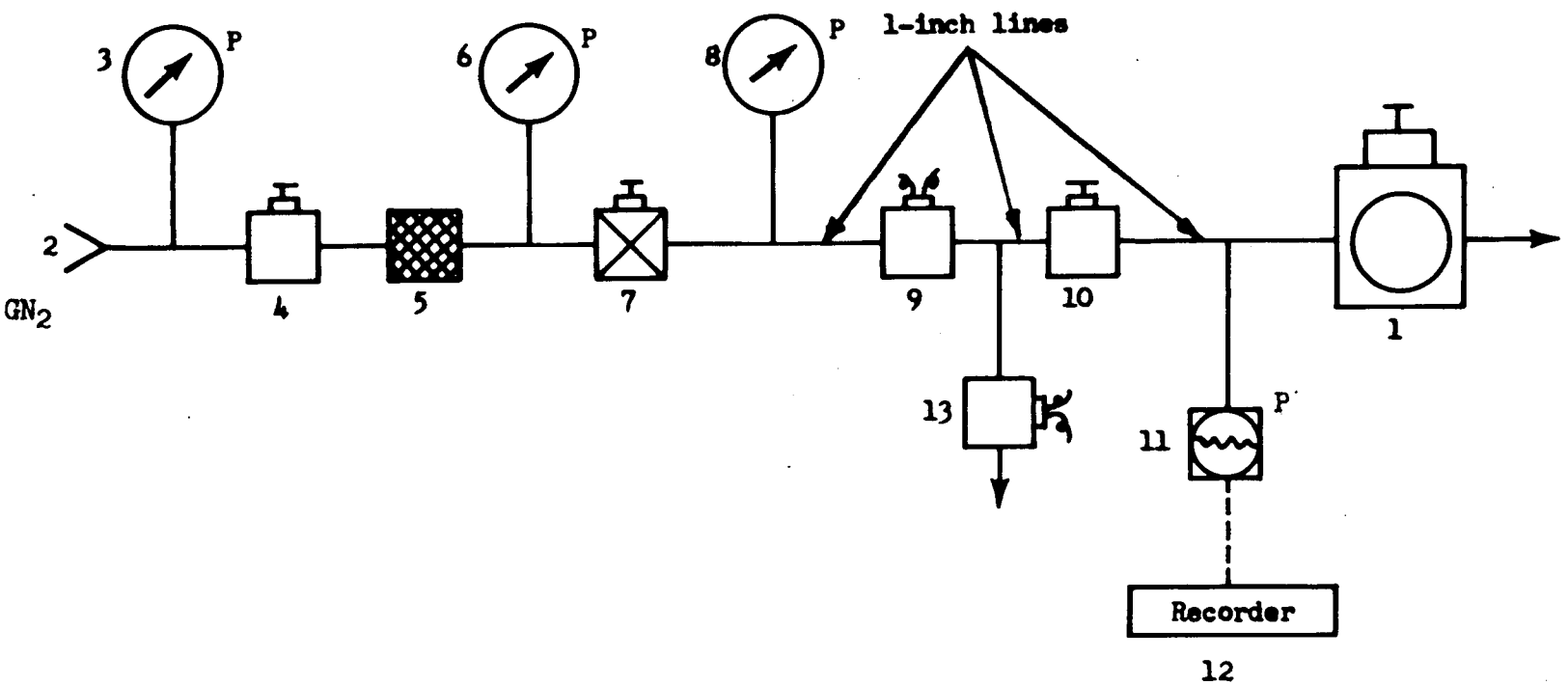
A typical surge test waveform is shown in figure 5-3. The functional test data presented in table 5-2 were recorded following the surge test.

Table 5-1. Surge Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch manually operated |
| 2 | $GN_2$ Pressure Source | | NA | NA | 3000-psig |
| 3 | Pressure Gage | Ashcroft | NA | 08-113 200595K | 0-to 5000-psig 1.0% FS accuracy Cal. date 10-21-66 |
| 4 | Hand Valve | Combination Pump and Valve Co. | NA | NA | 1-inch, 6000-psig |
| 5 | Filter | Bendix | 2-S-13460 16-B-0 | NA | 2 -micron |
| 6 | Pressure Gage | Ashcroft | NA | 200595V | 0-to 5000-psig 1.0% FS accuracy Cal. date 10-21-66 |
| 7 | Pressure Regulator | Grove Valve Co. | WH-408 -N3 | NA | 0-to 250-psig |
| 8 | Pressure Gage | Heise | H35830 | 200595W | 0-to 250-psig 0.1% FS accuracy Cal. date 10-21-66 |
| 9 | Solenoid Valve | Southwestern Valve Co. | MV-121 | NA | 1-inch |
| 10 | Hand Valve | Vacco Valve Co. | NV-6P-204-2MG | NA | 1-inch |
| 11 | Pressure Transducer | Consolidated Electrodynamics Corp. | 4-350-0001 | NA | 0-to 250-psig $\pm$0.1% FS accuracy Cal. date 8-28-66 |
| 12 | Oscillograph | Consolidated Electrodynamics Corp. | 5-124 | 08-113 012586 | Recording |
| 13 | Solenoid Valve | Marotta Valve Co. | MV510H | NA | 1/2-inch |

Table 5-2. Functional Test Data Obtained After Surge Test

| Outlet Pressure (psig) | Leakage From Inlet (sccm) | Inlet Pressure (psig) | Leakage From Outlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |




Note: All lines 1/4-inch unless otherwise indicated.
Refer to table 5-1 for item identification.

Figure 5-1. Surge Test Schematic

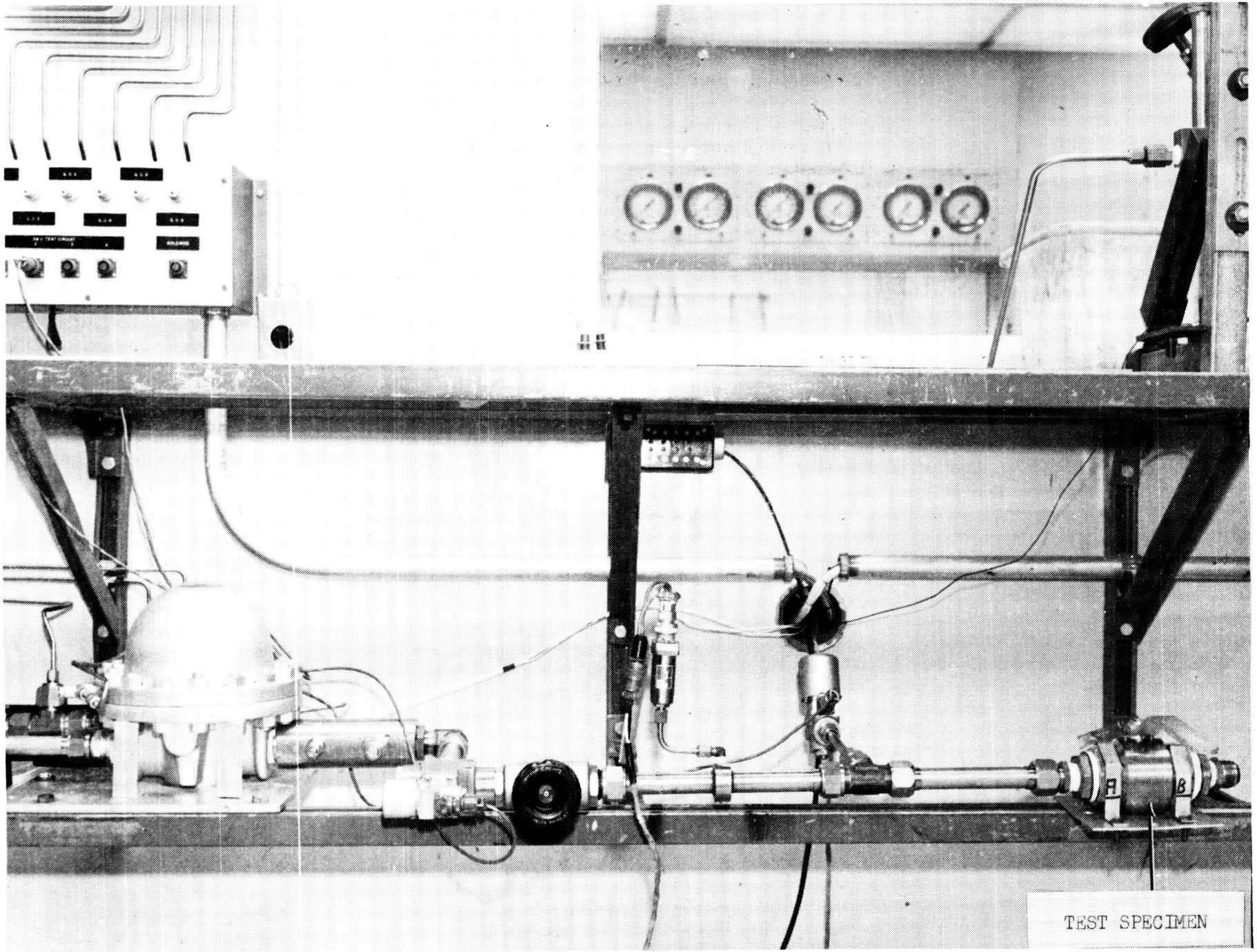



Figure 5-2. Surge Test Setup

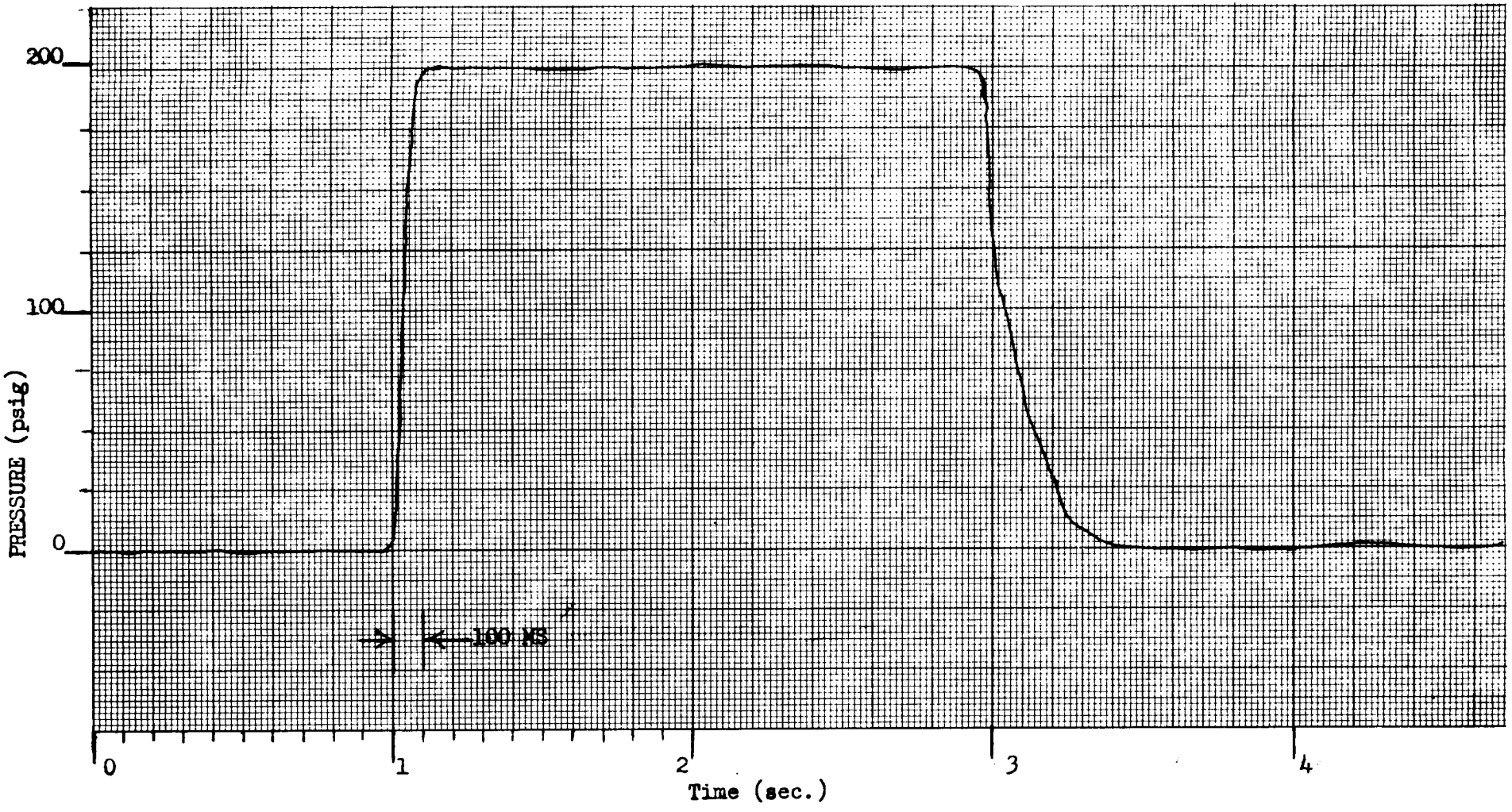



Figure 5-3. Typical Surge Test Waveform

SECTION VI

ICING TEST

6.1 TEST REQUIREMENTS

6.1.1 The test specimen shall be subjected to an icing test as specified in section 14 of KSC-STD-164(D).

6.1.2 The test specimen shall be subjected to a functional test during and after the icing test.

6.2 TEST PROCEDURE

6.2.1 The test specimen was installed in an icing chamber and the test setup shown in figure 4-1 was assembled using the equipment listed in table 4-1.

6.2.2 The temperature in the test chamber was stabilized at 5°F.

6.2.3 Precooled water at 40°F was injected into the test chamber at least 2 feet from the specimen. The injection of precooled water was continued until a minimum of 1/2 inch of ice had formed on the test specimen.

6.2.4 A functional test was performed as specified in section IV.

6.2.5 The temperature in the test chamber was returned to room ambient conditions.

6.2.6 After the specimen temperature had returned to room ambient temperature, a functional test was performed as specified in section IV.

6.3 TEST RESULTS

Test specimen **successfully completed the icing test.** Functional test results obtained during and following the icing tests were satisfactory.

6.4 TEST DATA

The functional test data presented in tables 6-1 and 6-2 were recorded during and following the icing test.

Table 6-1. Functional Test Data Obtained During Icing Test

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 6-2. Functional Test Data Obtained After Icing Test

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

# SECTION VII

# CYCLE TEST

## 7.1 TEST REQUIREMENTS

7.1.1 The test specimen shall be subjected to 1000 cycles.

7.1.2 Each cycle shall consist of opening and closing the test specimen.

7.1.3 A functional test as specified in section IV shall be performed after 50, 100, 500, and 1000 cycles.

## 7.2 TEST PROCEDURE

7.2.1 The operating lever of the test specimen was moved from the closed position to the opened position and back to the closed position. This operation constituted one cycle.

7.2.2 One-thousand cycles were performed.

7.2.3 A functional test as specified in section IV was performed after 50, 100, 500, and 1000 cycles.

## 7.3 TEST RESULTS

Functional test data obtained following 50, 100, and 500 cycles were satisfactory. However, leakage was recorded following 1000 cycles. An examination following 1000 cycles revealed flakes of seat material inside the valve (figure 7-1). **Therefore leakage is attributed to seat deterioration.**

## 7.4 TEST DATA

The functional test data presented in tables 7-1, 7-2, 7-3 and 7-4 were recorded following 50, 100, 500 and 1000 cycles respectively of the cycle test.

Table 7-1. Functional Test Data Obtained After 50 Cycles

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 7-2. Functional Test Data Obtained After 100 Cycles

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 7-3. Functional Test Data Obtained After 500 Cycles

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 7-4. Functional Test Data Obtained After 1000 Cycles

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leadage From Inlet (sccm) |
|---|---|---|---|
| 10 | 7.3 | 10 | 7.3 |
| 200 | 333 | 200 | 23 |
| 10 | 13.3 | 10 | 10 |

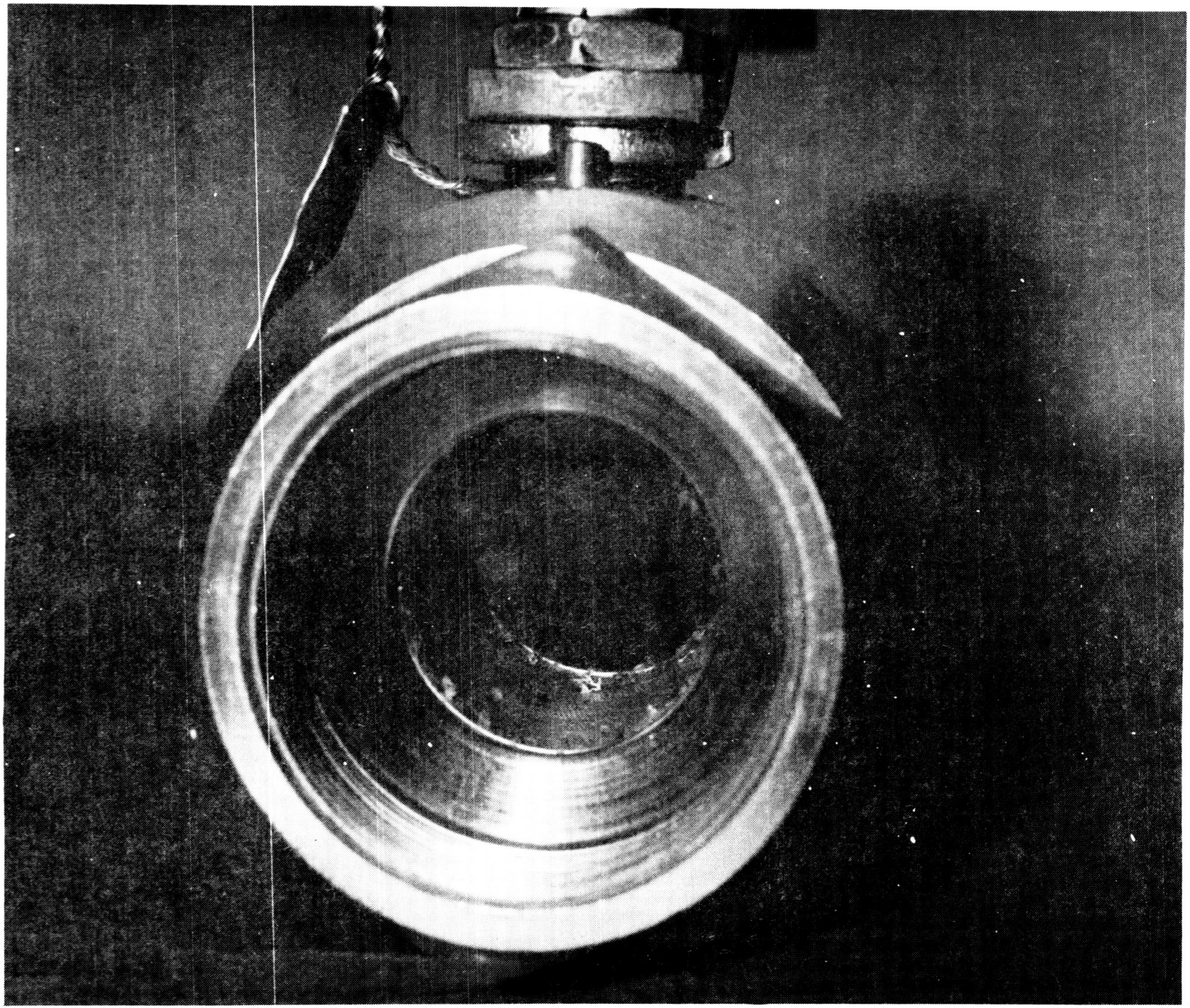


Figure 7-1. Specimen After 1000 Cycles

## SECTION VIII

## SAND AND DUST TEST

8.1 TEST REQUIREMENTS

8.1.1 A sand and dust test shall be conducted in accordance with section 16 of KSC-STD-164(D).

8.1.2 All of the ports of the test specimen shall be capped during exposure to the sand and dust environment.

8.1.3 A functional test shall be performed after the completion of this test.

8.2 TEST PROCEDURE

8.2.1 The test specimen was placed in the sand and dust chamber (table 8-1) in such a manner as to ensure the free flow of air around the specimen.

8.2.2 The density level of the sand and dust was maintained between 0.1 and 0.25 gram per cubic foot.

8.2.3 The chamber temperature was maintained at 77°F and an air velocity between 100 and 500 feet per minute for 2 hours.

8.2.4 Following this 2-hour period, the chamber temperature was raised to 125°F. The specimen was subjected to this condition for an additional 2 hours.

8.2.5 At the end of this exposure period, the specimen was removed from the chamber and the specimen was allowed to return to room ambient temperature.

8.2.6 Accumulated dust was removed by brushing, shaking, or wiping the test specimen. Introduction of dust to the interior of the test specimen was avoided. Neither airblast nor vacuum cleaning was used to remove excess dust.

8.3 TEST RESULTS

Test specimen sucessfully completed the sand and dust test. Functional test data obtained after the sand and dust were satisfactory.

## 8.4 TEST DATA

The functional test data presented in table 8-2 were recorded following the sand and dust test.

Table 8-1. Sand and Dust Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch manually operated |
| 2 | Sand and Dust Chamber | | NA | NA | As specified in KSC-STD-164 (D). |

Table 8-2. Functional Test Data Obtained After Sand and Dust Test

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

## SECTION IX

## SALT FOG TEST

9.1 TEST REQUIREMENTS

9.1.1 The salt fog test shall be performed to determine the resistance of the test specimen to a salt atmosphere.

9.1.2 The salt fog test shall be performed in accordance with section 17 of KSC-STD-164(D).

9.1.3 The test specimen shall be exposed to the salt fog for 240 (±2) hours. All ports of the test specimen shall be capped during exposure to the salt atmosphere.

9.1.4 A functional test shall be performed upon completion of the salt fog test.

9.2 TEST PROCEDURE

9.2.1 The test specimen was visually inspected for corrosion, dirt, and oily films. Oily films, other than those required for normal service usage, and all dirt particles were removed. The test specimen was placed in the salt fog chamber (table 9-1).

9.2.2 The temperature in the exposure zone was maintained at 95°F (+2, -4). The salt fog conditions in the exposure zone were maintained such that a clean fog-collecting receptacle placed in the exposure zone collected from 0.5 to 3 milliliters of salt solution per hour for each 80 square centimeters of horizontal collecting area (10 centimeters diameter), based on an average test of at least 16 hours. The salt solution consisted of five parts by weight of sodium chloride and 95 parts by weight of water.

9.2.3 The test specimen was exposed to the salt fog conditions for 240 (±2) hours.

9.2.4 Upon completion of the exposure test, the test specimen was removed from the chamber and salt deposits were removed from the specimen to the extent necessary to make machanical connections. Within 1 hour after completing the exposure period, a functional test was performed as specified in section IV.

9.3 TEST RESULTS

The test specimen successfully completed the salt fog test. The test specimen following the salt fog test is shown in figure 9-1.

Leakage was recorded during the functional test following the salt fog test. This leakage is not considered to be a result of the salt fog test. This leakage was previously noted during cycle testing.

9.4 TEST DATA

The functional test data presented in table 9-2 were recorded following the salt fog test.

Table 9-1. Salt Fog Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6 -T | NA | Ball valve, 2-inch manually operated |
| 2 | Salt Fog Chamber | Industrial Filter and pump Mfg. Co. | 411.1C | 08-113-004372 | As specified in KSC-STD-164(D) |

Table 9-2. Functional Test Data Obtained After the Salt Fog Test

| Inlet Pressure (psig) | Leakage From Outlet (sccm) | Outlet Pressure (psig) | Leakage From Inlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 210 |
| 10 | 0 | 10 | 0 |

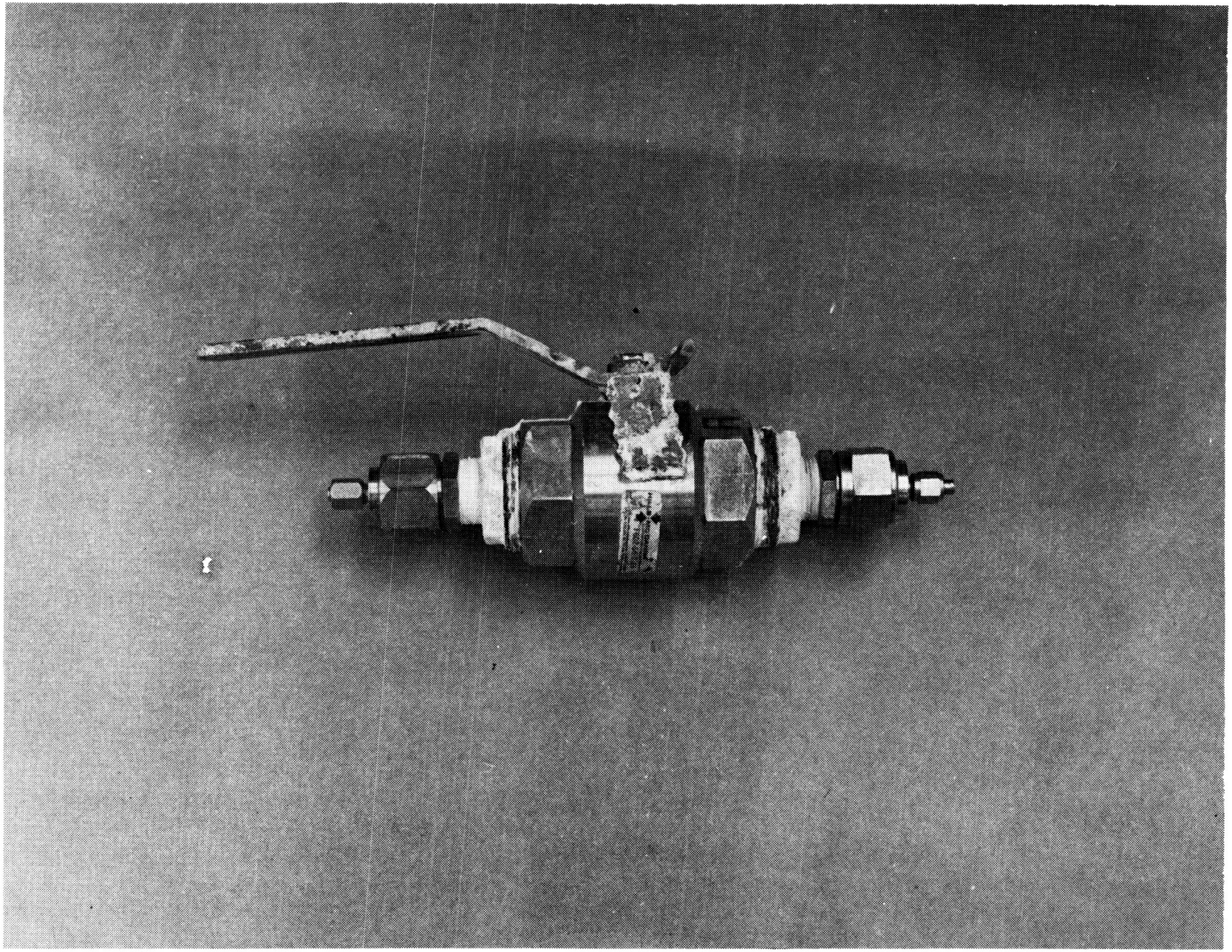


Figure 9-1. Specimen After Salt Fog Test

SECTION X

TEMPERATURE SHOCK TEST

10.1 TEST REQUIREMENTS

10.1.1 The test specimen shall be subjected to a temperature shock test in accordance with procedure I, section 7, of KSC-STD-164(D) at a chamber high temperature of 125°F and a low temperature of 0°F.

10.1.2 The test specimen shall be subjected to a functional test using He at 60 (+30 -0)°F as the medium during the high temperature and He at 0°F during low temperature exposure.

10.1.3 The test specimen shall be subjected to a functional test as specified in section IV following the completion of the temperature shock test.

10.2 TEST PROCEDURE

10.2.1 The test setup shown in figures 10-1 and 10-2 was assembled using the equipment listed in table 10-1. All hand valves and regulator 7 were closed.

10.2.2 Hand valve 4 was opened and the inlet of regulator 7 was pressurized to 3000 psig with GHe source 2.

10.2.3 The temperature of chamber 12 was raised to 125 (+5, -0)°F. The temperature of the specimen was stabilized at 125 (+5, -0)°F and the specimen temperature was monitored with thermometer 14.

10.2.4 The test specimen was pressurized to 10 psig by adjusting regulator 7. The test specimen pressure was monitored with pressure gage 8. Leakage was checked for 5 minutes. Leakage was monitored with water bath 10. All leakage data were recorded.

10.2.5 Regulator 7 was adjusted to pressurize the specimen to 200 psig for 5 minutes. Leakage was checked by monitoring water bath 10. All leakage data were recorded.

10.2.6 Test specimen pressure was reduced to 10 psig by adjusting regulator 7. Leakage was checked for 5 minutes by monitoring water bath 10. All leakage data were recorded.

10.2.7 Heat exchanger 16 was partially filled with $LN_2$.

10.2.8 Hand valve 9 was opened and regulator 7 was adjusted to flow GHe through hand valve 9. The GHe temperature was monitored with thermometer 13.

10.2.9 When the GHe temperature reached 0°F, hand valve 9 was closed. The test specimen and hand valve 15 were opened. GHe was allowed to flow through the specimen for 1 minute.

10.2.10 Immediately following the 1-minute period, the test specimen and hand valve 15 were closed. Hand valve 9 was opened slightly. A functional test as described in paragraphs 4.2.3 through 4.2.10 was performed using GHe at 0°F.

10.2.11 The test specimen was disconnected and then reinstalled in the test setup by connecting the outlet of the specimen to the presure line from regulator 7 and connecting the inlet of the specimen to the leakage detector line.

10.2.12 The tests described in paragraphs 4.2.3 through 4.2.10 were repeated by pressurizing the specimen outlet and checking for leakage from the specimen inlet.

10.2.13 Following the tests described above, the specimen was removed from the temperature chamber and allowed to return to room ambient temperature. A functional test as described in section IV was performed using $GN_2$ as the test medium.

## 10.3 TEST RESULTS

All functional test results during and after the temperature shock test were satisfactory. No leakage from the specimen was recorded.

## 10.4 TEST DATA

10.4.1 The data presented in table 10-2 were recorded while specimen was stabilized at 125°F prior to temperature shock.

10.4.2 The data presented in table 10-3 were recorded following the temperature shock test using GHe at 0°F as the test medium.

10.4.3 The data presented in table 10-4 were recorded with the specimen at ambient temperature following temperature shock test.

Table 10-1. Temperature Shock Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch, manually operated |
| 2 | GHe Source | | NA | NA | 3000-psig |
| 3 | Pressure Gage | Ashcroft | 1057S | NA | 0-to 5000-psig |
| 4 | Hand Valve | Robbins Aviation, Inc. | SSNA-250-4T | NA | $\frac{1}{4}$-inch |
| 5 | Filter | Bendix | 2-S-13460 16-B-0 | NA | 2-micron |
| 6 | Pressure Gage | Ashcroft | NA | 200595K | 0-to 5000-psig 1.0% FS accuracy Cal. date 10-21-66 |
| 7 | Pressure Regulator | Tescom | 26-1003 | NA | 0-to 500-psig outlet |
| 8 | Pressure Gage | Heise | NA | 08-113 106443 | 0-to 500-psig 0.1% FS accuracy Cal date 10-21-66 |
| 9 | Hand Valve | Robbins Aviation, Inc. | SSNA 250-4T | NA | $\frac{1}{4}$-inch |
| 10 | Water Bath | | NA | NA | |
| 11 | Graduated Cylinder | | NA | NA | 50-cc |
| 12 | Temperature Chamber | CCSD | NA | NA | 125°F |
| 13 | Thermometer | West Instrument Corp. | In. 5 | 08-113-019461 | $\pm$2°F Cal. date 10-3-66 |
| 14 | Thermometer | West Instrument Corp. | In. 5 | 08-113-019461 | $\pm$2°F Cal. date 10-3-66 |

Table 10-1. Temperature Shock Test Equipment List (Continued)

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 15 | Hand Valve | Robbins Aviation, Inc. | SSNA 250-4T | NA | $\frac{1}{4}$-inch |
| 16 | $LN_2$ Bath | | NA | NA | |

Table 10-2. Functional Test Data Obtained Before Temperature Shock Test

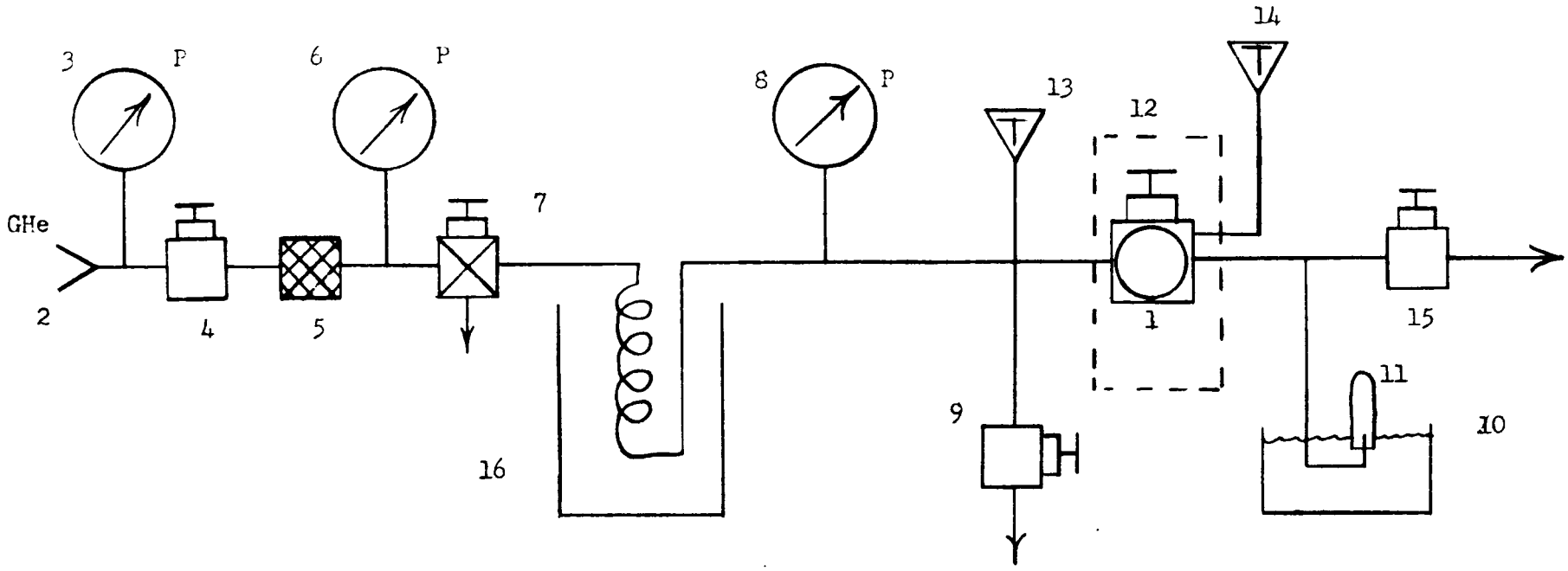
| Outlet Pressure (psig) | Leakage From Inlet (sccm) | Inlet Pressure (psig) | Leakage From Outlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 10-3. Functional Test Data Obtained After Temperature Shock Test

| Outlet Pressure (psig) | Leakage From Inlet (sccm) | Inlet Pressure (psig) | Leakage From Outlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |

Table 10-4. Functional Test Data Obtained With Specimen at Ambient Temperature After Temperature Shock Test

| Outlet Pressure (psig) | Leakage From Inlet (sccm) | Inlet Pressure (psig) | Leakage From Outlet (sccm) |
|---|---|---|---|
| 10 | 0 | 10 | 0 |
| 200 | 0 | 200 | 0 |
| 10 | 0 | 10 | 0 |




Note: All lines $\frac{1}{4}$ inch.
Refer to table 10-1 for item identification.

Figure 10-1. Temperature Shock Test Schematic

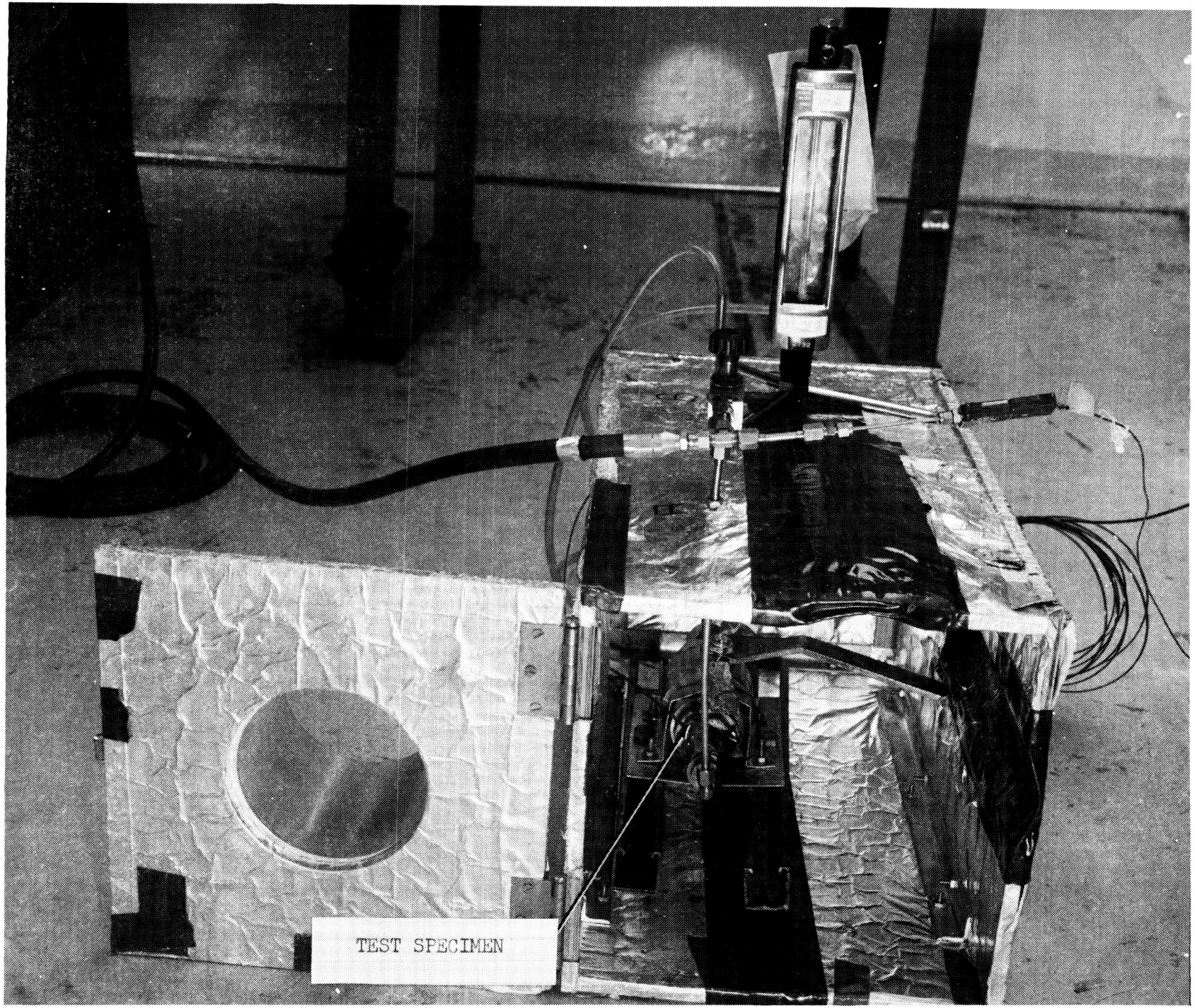



Figure 10-2. Temperature Shock Test Setup

# SECTION IX

# BURST TEST

## 11.1 TEST REQUIREMENTS

11.1.1 The test specimen shall be subjected to a hydrostatic pressure of 800 psig for 5 minutes.

11.1.2 The test specimen shall be checked for leakage and distortion.

11.1.3 The test specimen shall be subjected to an increasing hydrostatic pressure until rupture occurs.

## 11.2 TEST PROCEDURE

11.2.1 The test setup shown in figure 11-1 was assembled using the equipment listed in table 11-1. The specimen was installed in the burst protection chamber.

11.2.2 Hand valve 7 was closed. The test specimen 1 and hand valve 4 were opened.

11.2.3 The test specimen was pressurized to 800 psig by operating pump 3.

11.2.4 Hand valve 4 was closed. Leakage was checked for 5 minutes. Gage 5 was monitored for an indication of a pressure drop. The test specimen pressure was recorded at the beginning and at the end of the 5-minute period.

11.2.5 The test specimen pressure was relieved by opening hand valve 7.

11.2.6 Valve 7 was closed and hand valve 4 was opened. The test specimen was pressurized to rupture by operating pump 3. The rupture pressure was recorded.

## 11.3 TEST RESULTS

The test specimen was subjected to 800 psig for 5 minutes without evidence of leakage or distortion. The test specimen pressure was then increased until rupture occurred at 8000 psig. The specimen rupture was a separation of the adapter from the valve body (figure 11-2).

## 11.4 TEST DATA

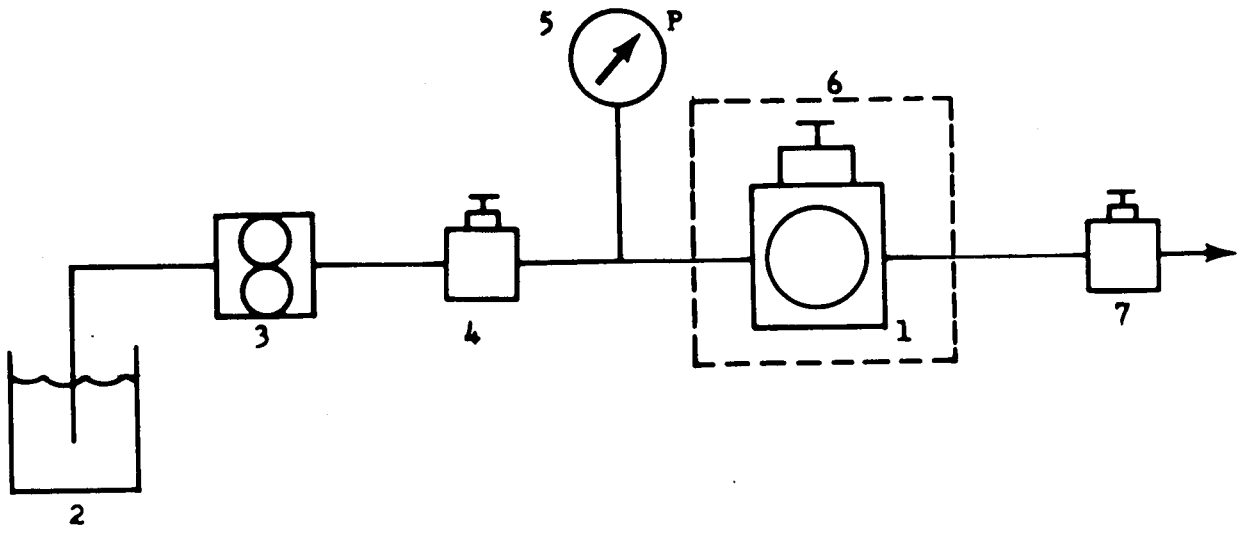
The data presented in table 11-2 were recorded during the burst test.

Table 11-1. Burst Test Equipment List

| Item No. | Item | Manufacturer | Model/ Part No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| 1 | Test Specimen | Hills-McCanna Co. | F602-S6-T | NA | Ball valve, 2-inch, manually operated |
| 2 | Water Reservoir | | NA | NA | |
| 3 | Water Pump | Sprague Engineering Company | 300-16-64 | NA | 0-to 35,000-psig |
| 4 | Hand Valve | Aminco | 44-13106 | NA | ¼-inch |
| 5 | Pressure Gage | Ashcroft | NA | 08-113-95-1395E | 0-to 10,000-psig 2.0% FS accuracy Cal. date 11-4-66 |
| 6 | Burst Protection chamber | CCSD | NA | NA | |
| 7 | Hand Valve | Aminco | 44-13106 | NA | ¼-inch |

Table 11-2. Burst Test Data

| Specimen Pressure (psig) | Leakage or Distortion |
|---|---|
| 800 psig for 5 minutes | None |
| 8000 psig | Rupture |




Note: All lines 1/4 inch.
Refer to table 11-1 for item identification.

Figure 11-1. Burst Test Schematic

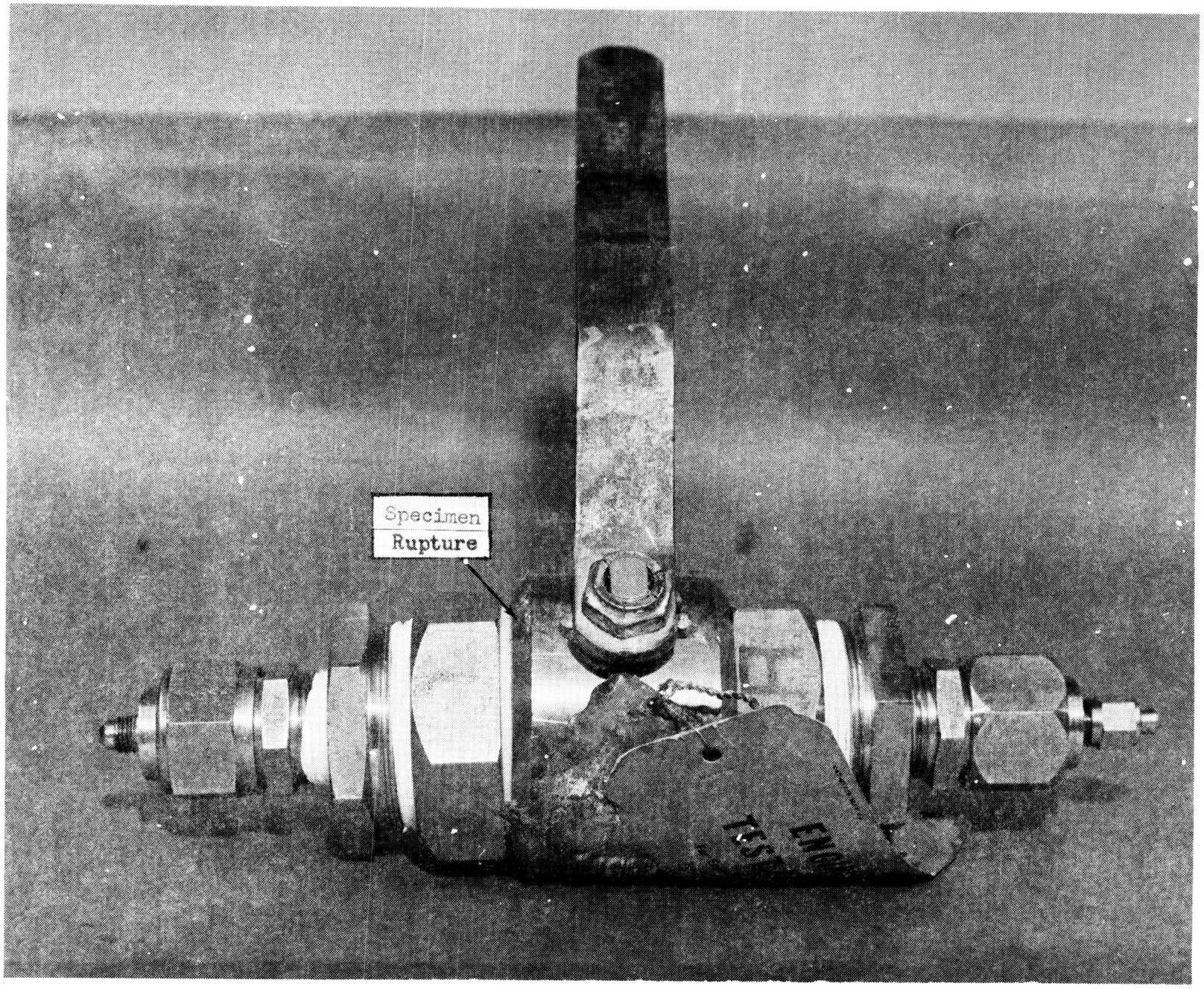



Figure 11-2. Specimen After Rupture

APPROVAL

TEST REPORT

FOR

BALL VALVE, 2-INCH, MANUALLY OPERATED

Hills-McCanna Co. Part Number F602-S6-T

NASA Drawing Number 75M04047 HBV-2

SUBMITTED BY:

P.D.M. Rogan
Test and Evaluation Section

APPROVALS

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